Obstacle Avoiding Robot

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***Abstract*—Obstacle detection and avoidance can beconsidered as the central issue in designingrobot. This technology provides the vehicle with senseswhich it can use to traverse in unfamiliar environments without damaging itself. In this paperan Obstacle Avoiding Robot is designed which can detect obstacles in its path and maneuver around them without making any collision. It is a robot vehicle that works on Arduino Microcontroller and employs a ultrasonic distance sensors to detect obstacles. The Arduino board was selected as the microcontroller platform and its software counterpart, Arduino Software, was used to carryout the programming.The integration of threeultrasonic distance sensors provides higher accuracy in detecting surrounding obstacles. Being a fully autonomous robot, it successfully maneuvered in unknown environments without any collision. The hardware used in this project iswidely available andinexpensive which makes therobot easily replicable.**

I. INTRODUCTION

From its initiation in the 1950s, modern robots have come a long way and rooted itself as an immutable aid in the advancement of humankind. In the course of time, robots took many forms, based on its application, and its size varied from a giant 51 feet to microscopic level. In the course of technological developments of robots, one aspect remained instrumental to their function, and that is mobility. The term "obstacle avoidance" is now used in modern robotics to denote the capability of robot to navigate over an unknown environment without having any collision with surrounding objects (Duino-Robotics, 2013). Obstacle avoidance in robotscan bring more flexibility in maneuvering in varying environments and would be much more efficient as continuous human monitoring is notrequired.This project developed an obstacleavoiding Robot which can move without any collision by sensing Obstacles on its course with the help of three ultrasonic Distance sensors. Robots guided with this technology can be put into diversified uses, e.g., surveying Landscapes, driverless vehicles, autonomouscleaning, Automated lawn mower and supervising robot in Industries. The robot developed in this project is expected to fulfill the following objectives:

- The robot would have the capacity to detect Obstacles in its path based on a predetermined Threshold distance.
- After obstacle detection, the robot would change its Course to a relatively open path by making Autonomous decision.
- It would require no external control during its Operation.
- It can measure the distance between itself and the Surrounding objects in real-timecamera. The code was designed to receive the distance toobject, its height and width.Our project employs multiple sensors.
- It would be able to operate effectively in unknown Environment.

II. RELEVANT WORKS IN OBSTACLE DETECTION ANDAVOIDANCE

To date, there has been a number ofsuccessful attempts indesigning obstacle avoiding robots. There have been numerous projects in this arena using laser scanner, infrared sensor, GPS and multiple sensors toaccomplish obstacle detection and avoidance.

Researchers are persistently trying to find more precise ways to develop autonomous robot orvehicle movementtechnology. In obstacle detection, the Selection of sensor is vital for the required application ofThe robot, otherwise it might fail to operate even though All hardware and software are working properly. For Example, a robot with optical sensors in a room with Glass walls might create more collisionsthan avoidance. Hence sensors should be selected inaccordance with the characteristicsof the obstacles. RytHer and Madsen (2009) Used 240°

laser scanner as a sensor tobuild a Robot based on Small Mobile Robot (SMR) platform.The Robot generates a collision free path from grid map using wave front algorithm

The robot developed in this project usesultrasonic sensors to detect obstacles in real time and Infrared sensor to follow a line. Its processing unit is basedon the Arduino platform.

The Autonomous Surface Vehicle (ASV) developed by Heidarsson and Sukhatme (2011)employed a single-beam mechanically-scanningprofiling sonar to detect obstacles under water. Theprofiling sonar has the ability to produce cone-shapedbeam which is ideal for detecting near surfaceobstacles. One of the objectives of their work was toinvestigate the suitability of using sonar near the water-airboundary for which the study found promising results. Although similar detection technology is used, our robot is designed to work on the ground anddetect obstacles above the surface. It is uses the Arduino software which enables to upload a code written in Cprogramming language.

There were other works using multiple sensors to make the robot more accustomed to itssurroundingsby employing both range and appearance based obstacle detection (Shahdib, Ullah, Hasan, & Mahmud,2013; Gray, 2000). Their obstacle detection also includes a combination of global and localavoidance. Inone of these projects, Shahdib, Ullah, Hasan and Mahmud (2013) fused the strengths of an imageand an ultrasonic sensor to detect objects and measureits size. Detection of object was carried out by the ultrasonic sensor and its measurement required the help of a sensors for enhancing the horizontal range of searching obstacles. These ultrasonic distance sensors work incombination to measure distance to the surrounding objectsand detect the presence of obstacles if they are within the threshold distance. The inclusion of three sensors of the same kind provides more accuracy in obstacle detection as itwidens the field of searching.

III. WORKING PRINCIPLE

The robot in this project detects obstacles with the help of a ultrasonic distance attached to a servo motor to Measures the distanceto surrounding objects. Although Theproject is started with a ultrasonic sensorattached directly onthe chassis, a server motor wasadded since the robot had blind spots In its right and left direction for which it was having collision while maneuvering. Unlike the projects discussed above, our projectconcentrates onCoordinating ultrasonic sensors andmotor for Maneuvering without collision and also maintaining a Minimum travel distance. The robot was designed to detect the presence of any object within the specified threshold distance. If any object is found within this distance, it is designated as an obstacle and the robot will turn away from it. The ultrasonic sensor is placed in the frontal section of the robot at the middle. The sensors emit an ultrasonic pulse every 300 ms which echoes from the neighboring objects. Usingtime difference between the input and echo, theArduino calculates the distance to the obstaclefrom which the Echo is coming by using the constant speed of sound 340 m/s. When one of the sensors detects obstacle within the threshold distance, the robot changes its direction. Along with these basic movements, the robot Is designed to handle a more complexsituation when all three direction have obstacles within the specified range. In thiscase, the robot will move backward for 10ms and Again check the distance toobjects with the help of motor. The robot will then compare the two distances and move in the direction where the distance Is larger.

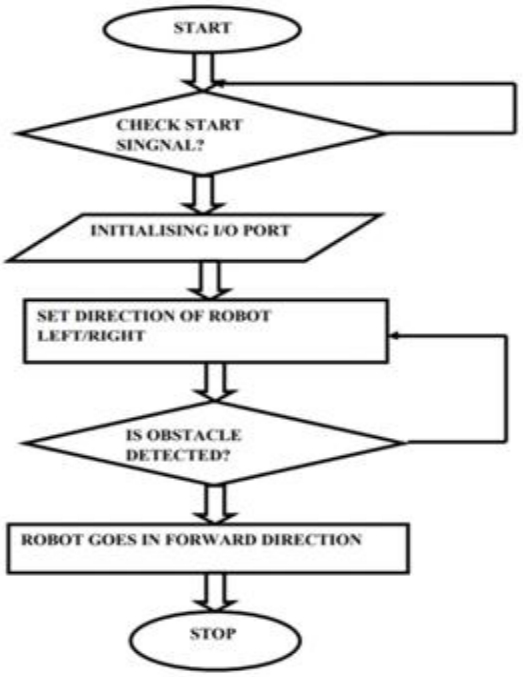

Fig.1 Flow chart of the project

IV. ROBOT ARCHITECTURE AND PROGRAMMING

a) The Arduino Platform

There's are numerous hardware platforms in use based on which obstacle avoiding robots or in general mobile robots are built. We have selected the Arduino board as the microcontroller platform and its software counterpart to carry out the programming. Arduino is an open-source platform which is an integration of hardware (microcontroller) and software components. The microcontroller can read input in the form of light or sound through a sensor and convert it into an output (e.g., driving a motor) according to the instruction given by the Arduino programming (Arduino, 2015).

The Arduino microcontroller can only be functional withthe help of a code. To write this code, Arduino Integrated Development Environment or Arduino Software (IDE) is used which is also open source like the Arduino Uno board(Arduino, 2015). It is much popular software used bymany for its simplicity and the ability to communicatewith all Arduino boards. Arduino Software version 1.6.5is used to write the code in C programming language which is then uploaded to the Arduino microcontroller through an USB cable. The software saves the code in a file with .ino extension. While there are many other microcontroller platforms available, Arduino gained much popularity which attributed to its distinctive features such as:

- Economical
- It can run in various platforms like Windows, Linux And Macintosh
- Programming environment is easy to comprehend
- Both software and hardware are open source and can be customized to meet specific needs.

In this project, the Arduino board will take input from Ultrasonic sensor, calculate the distance to theobstacle and Control rotation of the servo motor as anoutput response And also control the servo motorunder the ultrasonic Sensor to find a new path if therobot is obstructed by an Obstacle.

b) Hardware Components and Assembly

The following flowchart in Fig.2 shows the Hardware used to build the robot and explains Relationship (input and output) among them

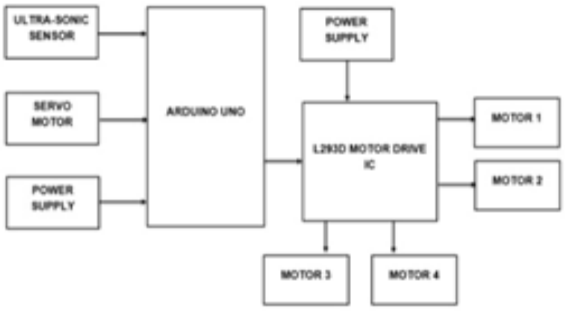

Fig.2:- Block diagram

The hardware was assembled to form the obstacle avoiding robot in Fig.3 with the help of a chassis, wheels and connecting cables.

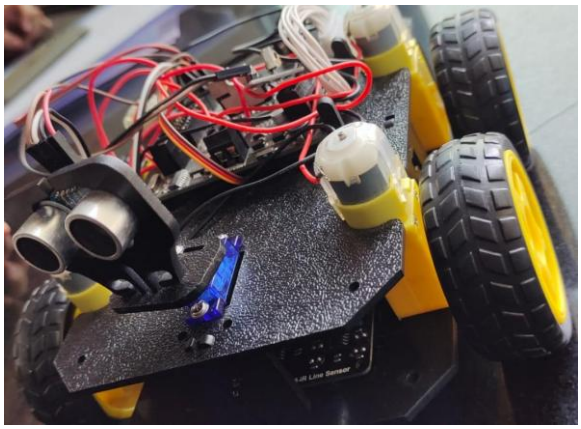

Fig.3:- Front view of the project

V. CONCLUSION

This project developed an obstacle avoiding robot to detectand avoid obstacles in its path. The robot is built on theArduino platform for data processing and its software counterpart helped to communicate with the robot to send parameters for guiding movement. For obstacle detection, three ultrasonic distance sensors were used that provideda wider field of detection. The robot is fully autonomousand after the initial loading of the code, it requires no userintervention during its operation. When placed inunknown environment with obstacles, it moved while avoiding all obstacles with considerable accuracy.

The work done in this project can act as a base for further improvements to increase accuracy and adaptability of obstacle detection in diverse environments. In future, theauthors of this project intend to test the feasibility of integrating different types of sensors to complement each other's disadvantages. For instance, imaging sensor can

beBeneficial when ultrasonic sensor may not correctly l identify obstacles inenvironment subjected to ambient noise and varying temperature or air pressure. The accuracy of determining the distance to the obstacles canbe increased by the inclusion of an electronic barometerfor automaticadjustment of the speed of sound in air. Also the addition bluetoothdevice can offer the flexibility of remotely changing control parametersin the cod

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